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Feature Article - Using the unemployment rate series to illustrate the seasonal adjustment process

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INTRODUCTION

The Australian Bureau of Statistics (ABS) has been publishing for many years an array of economic indicators - employment, retail trade, building approvals, capital expenditure and GDP to name a few. To understand the underlying behaviour of the original series over time, the ABS estimates and publishes seasonally adjusted and trend series. Seasonally adjusted series have had systematic calendar related influences including seasonal influences removed from the original series, and trend series have had both systematic calendar related influences and irregular influences removed.

This article uses the monthly unemployment rate series to show how seasonally adjusted and trend estimates are derived by the ABS. The article demonstrates why the ABS recommends using trend series for interpreting the underlying behaviour of a series. In doing so, the article also addresses the nature of the seasonal and irregular influences that can be seen in the unemployment rate series and whether these are changing over time.

DECOMPOSING TIME SERIES

To assist informed decision making, ABS time series statistics are published in three forms: original, seasonally adjusted and trend.

Original estimates are the actual estimates the ABS derives from the data supplied by respondents to its surveys. Original estimates are affected by systematic calendar related influences, irregular influences and trend behaviour.

Seasonally adjusted estimates are derived by estimating the systematic calendar related influences and removing them from the original estimates. Seasonally adjusted estimates still contain irregular influences that can mask the underlying behaviour of a series.

Trend estimates remove from the original estimates both systematic calendar related influences and irregular influences, resulting in estimates that provide a better measure of the underlying behaviour of the series.

Systematic calendar related influences

There are two main types of systematic calendar related influences contained in original estimates: seasonal influences and trading day influences.

Seasonal influences occur for a variety of reasons.

- They may simply be related to the seasons and related weather conditions such as warmth in summer and cold in winter. Weather conditions that are out of character for a particular season, such as snow in December, would appear as irregular, not seasonal, influences.
- They may reflect traditional behaviour associated with various social events (eg. Christmas and the associated holiday season).
- They may reflect the effects of administrative procedures (e.g. quarterly provisional tax payments and end of financial year activity).

Trading day influences refer to activity associated with the number and type of days in a particular month. For instance, a calendar month typically comprises four weeks (28 days) plus an extra two or three days. If these extra two or three days are associated with high activity, then activity for the month overall will tend to be higher.

Seasonal and trading day factors are estimates of the effect which the calendar related influences have on ABS time series. These evolve to reflect changes in patterns of activity over the life of the time series.

Irregular influences

Irregular influences are unpredictable and are not systematic or calendar related. Examples of irregular influences are those caused by one off events such as major industrial disputes or abnormal weather patterns. Sampling and non-sampling errors that behave in an irregular or erratic fashion with no noticeable systematic pattern are also irregular influences.

DECOMPOSING UNEMPLOYMENT RATE ESTIMATES

It follows that movements in the unemployment rate time series can be attributed to three components:

- systematic calendar related influences
- irregular influences, and
- trend movements.

Seasonally adjusted estimates are derived by estimating and removing the systematic calendar related influences. There are no recognisable trading day influences in the unemployment rate series because the unemployment rate always refers to a two week collection period within a particular month. Therefore, only the seasonal influences need to be estimated and removed from the original unemployment rate series to derive a seasonally adjusted series.

In order to produce seasonally adjusted estimates, the ABS uses a modified version of the US Bureau of the Census X11 procedure, the procedure most widely used by statistical agencies

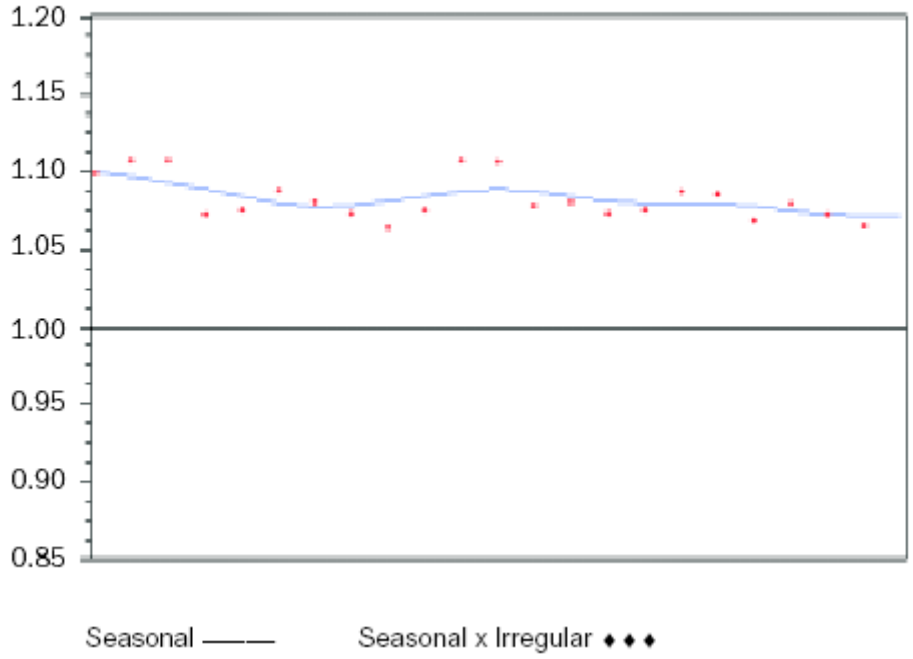
around the world. The X11 procedure is iterative. The first step is to estimate and then remove an initial estimate of trend from the original data to produce a series that contains only seasonal and irregular influences. The series is then partitioned into months, and the seasonal and irregular influences for each month are smoothed to obtain an initial estimate of the seasonal pattern.

This first estimate of the seasonal pattern is then removed from the original series to leave an initial estimate of the seasonally adjusted series, which is in turn smoothed to obtain an improved trend estimate. This process is repeated three times to obtain final estimates of the seasonal and irregular factors.

Graph 1 illustrates, for January, estimates of the seasonal and irregular factors. The horizontal axis represents years. The combined seasonal and irregular factors (represented by diamonds) and the smoothed seasonal pattern (represented by the line) are plotted against the vertical axis. A seasonal/irregular of 1.1, for example, indicates that the estimate for January that year was 1.1 times that of an average month (or 10% larger than an average month).

1. UNEMPLOYMENT RATE SEASONAL AND IRREGULAR FACTORS, JANUARY

Period covered from January 1979 to January 2000



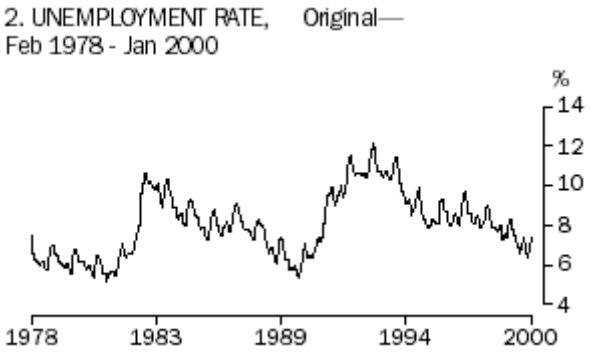
The final step in the adjustment process is to obtain ABS trend estimates by applying a 13 term Henderson moving average to the final seasonally adjusted unemployment rate series.

In practice, the seasonally adjusted unemployment rate series is derived from the Australian level seasonally adjusted employed persons series and seasonally adjusted unemployed persons series. Both of these series are aggregates of six component series that are individually seasonally adjusted. Thus there are twelve component series contributing to the seasonally adjusted unemployment rate estimate.

The following sequence of diagrams (technically referred to as a shiskin graph after Julius Shiskin, U.S. Bureau of the Census) steps through the time series decomposition of the unemployment rate series. Graphs 2 to 6 illustrate the contributions of the seasonal, irregular and

trend to the behaviour of the original unemployment rate series.

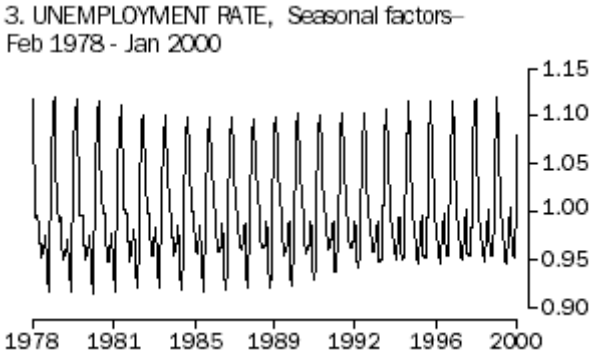
The original estimates are represented in graph 2. It shows that since February 1978, the underlying movement in the Australian unemployment rate has been periodic with cyclical swings. ‘Spikes’ in the series occur regularly or systematically over time.



In January 2000, the original Australian unemployment rate was 7.35%.

Graph 3 illustrates the seasonal behaviour of the Australian unemployment rate series. Graph 3 has been scaled differently to Graph 2 to enable seasonal fluctuations in the unemployment rate to be seen more clearly.

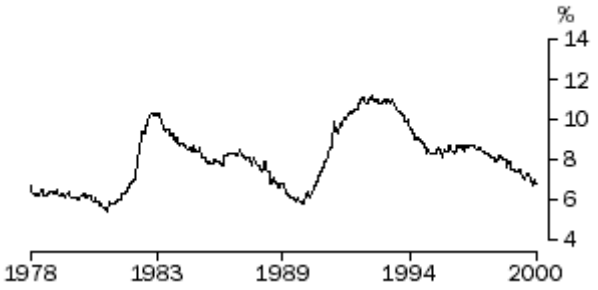
The seasonal factors have displayed a fairly consistent pattern over time, spikes occurring in February followed by troughs in July. From this graph we can see that the unemployment rate series is definitely seasonal and hence the underlying movement in the original series is indeed masked by a seasonal influence.



In January 2000, the seasonal factor was 1.08, indicating January 2000 is 8% above neutral (1.00).

The seasonally adjusted series (graph 4) is obtained by removing the seasonal factors from the original series. This results in a smoother series than the original. On average, the absolute monthly percentage change of the seasonally adjusted series is only 2.11 compared with 4.22 for the original series in graph 2. Note that the underlying direction of the seasonally adjusted series has not been distorted by the removal of systematic calendar related influences.

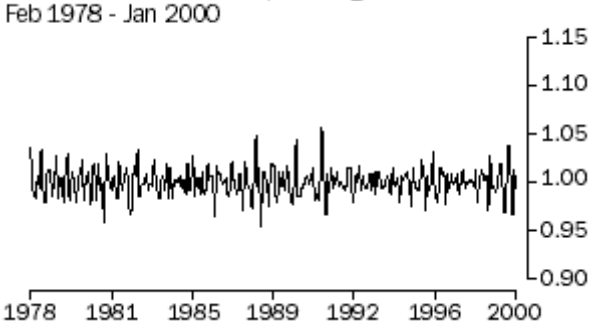
4. UNEMPLOYMENT RATE, Seasonally adjusted
Feb 1978 - Jan 2000



The January 2000 seasonally adjusted estimate (6.81%) is obtained by dividing the original estimate (7.35%) by the seasonal factor (1.08).

Irregular or random influences, which can mask the underlying month to month movement in a series, are still present in the seasonally adjusted series. Graph 5 presents the irregular factors for the Australian unemployment rate.

5. UNEMPLOYMENT RATE, Irregular factors—
Feb 1978 - Jan 2000

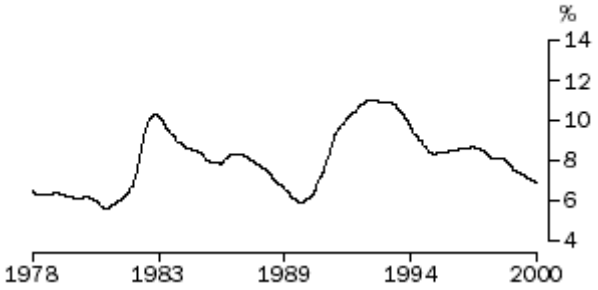


The irregular factors do not display any consistent pattern, are not increasing or decreasing over time, and are small in comparison to the seasonal factors. Occasional abnormally large or small irregular factors can occur in this series, but are not systematically calendar related.

In January 2000, the irregular factor was estimated to be 0.99, indicating the seasonally adjusted estimate was 1% below the trend estimate.

Graph 6 presents the trend for the Australian unemployment rate series. It represents the underlying direction of the original series after seasonal and irregular influences have been removed. This results in a smoother series than the original and the seasonally adjusted series. On average, the absolute monthly percentage change of the trend is about 1.02.

6. UNEMPLOYMENT RATE, Trend
Feb 1978 - Jan 2000



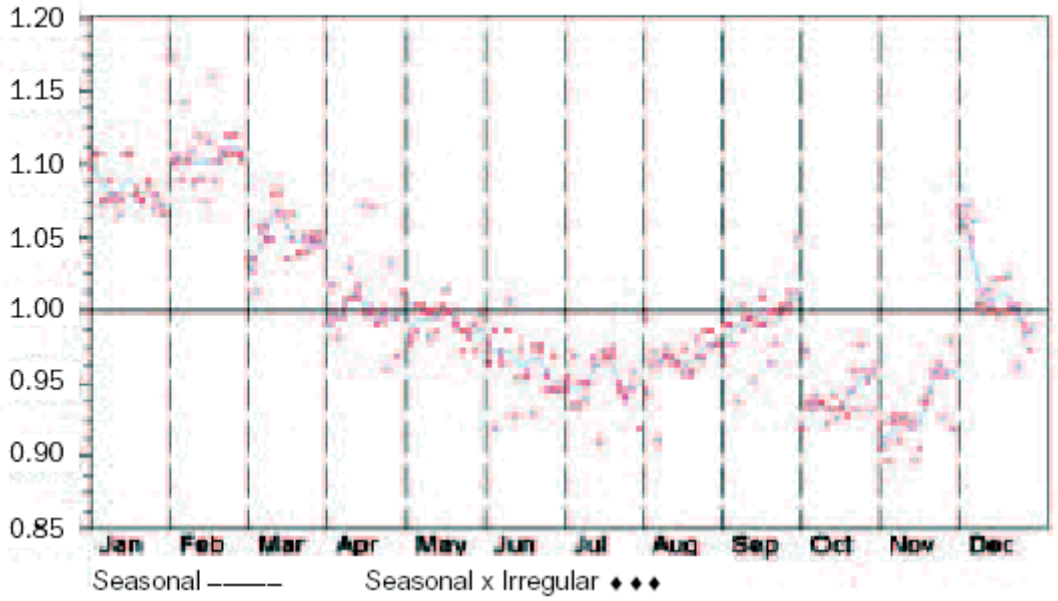
The January 2000 trend estimate (6.86%) can be obtained by dividing the seasonally adjusted estimate (6.81%) by the irregular factor (0.99) prior to rounding.

CHANGES IN SEASONAL PATTERNS

The seasonal pattern in the unemployment rate series for all months is shown in graph 7. Graph 7 is similar to graph 1, except that it shows all 12 months of the year, not just January. Values of the seasonal factors above the neutral line (of 1.00) indicate seasonally high months, and those values below the line indicate seasonally low months. January and February are seasonally high months and October and November are seasonally low months. Over time, December has moved from being a seasonally high month to a seasonally low month. The largest fall in seasonality in December occurred in 1983.

7. UNEMPLOYMENT RATE SEASONAL AND IRREGULAR FACTORS

Period covered February 1978 to January 2000



HOW IRREGULAR ARE THE IRREGULARS?

The largest irregular factor in the unemployment rate series in the past 22 years occurred in April 1991, when the seasonally adjusted estimate was 6% above the trend. The largest negative factor occurred in July 1988 when the seasonally adjusted estimate was 5% below the trend estimate. In recent times, the irregulars have not been larger than usual.

The volatility in a seasonally adjusted series occurs as a consequence of the irregular influences remaining in it. Both the seasonal and irregular factors presented in graphs 1 and 7 and the irregular factors in graph 5 provide an indication of the size of the irregular factors relative to the seasonal factors for the unemployment rate series.

As well, the clustering of the combined irregular and seasonal factors (shown as diamonds) around the seasonal factors (line) in graph 7 provides an indication of the volatility of particular

months. No one month stands out as particularly more volatile than any other month. January, March, May, August, October and December appear particularly smooth. In recent times, November appears more volatile compared with other months.

TAKE CARE IN INTERPRETING MONTH TO MONTH MOVEMENTS

There are three contributions to the 7.1% movement in the original unemployment rate for January 2000 (from 6.86% in December to 7.35% in January):

- 9.7% increase in the seasonal factor, from 0.98 to 1.08;
- 0.8% fall in the trend, from 6.91% to 6.86%; and
- 1.8% fall in the irregular factor, from 1.01 to 0.99.

Looking at this another way, the 2.6% fall in the seasonally adjusted estimate from 6.99% to 6.81% in January 2000 comprises:

- 0.8% fall in the trend estimate; and
- 1.8% fall in the irregular.

Clearly, the irregular component dominated the overall movement in the seasonally adjusted estimate. This high contribution of the irregular makes the direction of the month to month movement of the seasonally adjusted series difficult to interpret with confidence.

This dominant impact of the irregular component in period to period movements occurs in most economic series and is the reason why the ABS recommends using the trend series for interpreting the underlying behaviour of a series.

FOR FURTHER INFORMATION

For further information, please contact the Assistant Director, Labour Force Estimates on 02 6252 6565.

For email enquiries, please contact Client Services on client.services@abs.gov.au.

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